

Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Nonlinear optics with polar molecules in optical lattices T.S. BRAGDON, E.I. KUZNETSOVA, University of Connecticut, Storrs CT, S.F. YELIN, ITAMP, Cambridge MA, University of Connecticut, Storrs CT — We explore the feasibility of ultracold polar molecules in optical lattices for realization of efficient photon-photon interactions in quantum information processing. Photon-photon interaction is implemented by converting photons into collective molecular excitations using dark-state polaritons via the electromagnetically induced transparency effect. As a result of dipole-dipole interaction between polar molecules in the lattice the polaritons acquire a nonlinear phase shift, which allows one to realize a photonic phase gate. We discuss major decoherence mechanisms, such as decay from symmetric molecular collective excited states, and explore doubly occupied lattices as a means to avoid this difficulty.

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Date submitted: 27 Jan 2009

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